

Preface

Since the discovery of the phenomenon of superconductivity in mercury by Heike Kammerlingh Onnes in 1911, the search for new compounds with higher transition temperatures has presented a continuous challenge in the field of materials science. After the discovery of the Nb_3Sn superconductors with A15-type structure, the efforts, mainly concentrated on intermetallic compounds, experienced steady but slow success. With a T_c of 23.3 K in Nb_3Ge , however, a limit seemed to have been approached. Reports of materials with higher T_c appeared occasionally, but these could not withstand the critical tests. Superconductivity research was just celebrating its 75th anniversary in 1986, when interest in the field was sparked by the discovery of a new class of metallic perovskite-type copper-based oxides with transition temperatures of 35 K.

Following this discovery and its worldwide confirmation, a "gold rush" activity set in, concerning both the "claims" from the materials sector and theoretical models. The large variety of new superconducting—normal state and structural—properties led to the involvement of almost all disciplines in solid state physics and chemistry. The first international conference on high- T_c superconductivity was held at Interlaken, Switzerland, at the end of February 1988, and with its large attendance was a successful forum for presenting the substantial achievements in all sectors of the field. At this conference, the highest T_c attained so far was reported. At major conferences, however, the desire to deepen the understanding among experts in a more relaxed environment is often felt. Such an opportunity is offered by a workshop with a properly balanced program. Therefore, it was decided to organize a workshop in Oberlech under the aegis of the IBM Europe Institute which, since its establishment in 1982, has hosted seminars and workshops in many different fields.

So far, advances in the high- T_c field have been led by materials preparation, structural and experimental analysis. Thus, it was decided to place a certain emphasis on these areas, especially since two weeks before Oberlech the Adriatico Meeting in Trieste was scheduled, with a focus on theory weighted toward resonance valence bonding (RVB) theory. Therefore, the Oberlech Workshop was organized to be complementary to Trieste, while still including relevant theory. In this spirit, we invited scientists who have made significant contributions in the field and colleagues whose experimental results would improve our understanding. The intention was that after the presentations by their peers, the participants could and would delve into the various subjects during subsequent discussions. This indeed was the case.

The primary concept was to allow ample time for the lectures, comments, and subsequent questions. Therefore, three lectures were presented each morning, and only two in the afternoon. The first two lectures in the morning were experimental, and the third, directly related to them,

theoretical. All except two of these lectures appear in this issue of the *IBM Journal of Research and Development*. As the reader can judge, they are of truly high quality. The undersigned warmly thank the lecturers for their substantial efforts in preparing their manuscripts.

In these proceedings, the lectures appear in the same sequence in which they were presented in Oberlech. This has been done not only to recall to the participants the pleasant days spent in Oberlech, but mainly because that particular sequence was chosen for didactic reasons. Beginning with an overview of the current understanding and important results, structural aspects were presented first. Experiments revealing the electronic properties were next on the agenda, followed midweek by the important magnetic properties and a much-needed break of half a day. Since the new high- T_c superconductors have very short coherence lengths, a full day was devoted to the properties stemming from them. On the last day, the newest results gained with various techniques, as well as from theoretical models, were presented.

After concluding each workshop, the IBM administrative staff conducts a poll. The highest result they ever received was for this High- T_c Workshop! Enthusiasm for the week in Austria was also expressed personally to the undersigned by many participants, so we hope that this proceedings volume may, to a certain extent, adequately reflect the Oberlech impressions in quality, correctness, and fairness.

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